

## ADDENDUM.

As an addendum to Mr. Dyar's system of classification, it may be well to notice a short summary published by him in "Entomological News," \* Feb., 1895, pp. 38-40. In this he writes:—"I would divide Prof. Comstock's FRENATÆ into six superfamilies on the arrangement of the tubercles of the larvæ. In response to a tendency for these tubercles to be arranged in a single transverse row, tubercles iv. and v. have become consolidated into one in the first three superfamilies, and later, tubercles i. and ii. have been likewise united, or else tubercle ii. disappears. In the three highest families the tubercles have tended to form two alternating rows. According to these characters the superfamilies separate as follows:—

- "Tubercles iv. and v. approximate or consolidated.
- "Tubercles i. and ii. remote . MICROLEPIDOPTERA.
- "Tubercles i. and ii. consolidated . ANTHROCERINA.
- "Tubercles i. and ii. remote, ii. disappearing at the first moult . . BOMBYCINA.
- "Tubercles iv. and v. remote.
- "Tubercle iv. behind the spiracle,  
v. below it . . . . . NOCTUINA.
- "Tubercle iv. below, v. in front of  
spiracle . . . . . SPHINGINA.
- "Tubercles iv. and v. in line, except  
in some *Nymphalidæ*, where  
secondary armour is developed . RHOPALOCERA.

"The MICROLEPIDOPTERA include the *Psychidæ*, *Cossidæ*, *Pyralidæ*, *Tortricidæ*, *Sesiidæ*, *Tineidæ*, and *Lacosomidæ*. The ANTHROCERINA include the *Pterophoridæ*, *Anthroceridæ*, *Pyromorphidæ*, *Megalopygidæ*, and *Eucleidæ*. The BOMBYCINA—the *Citheroniidæ*, *Hemileucidæ*, † *Saturniidæ*, † and *Bombycidæ*. The NOCTUINA—the *Notodontidæ*, *Thyatiridæ*, *Geometridæ*, *Drepanidæ*, *Agaristidæ*, *Noctuidæ*, *Cymbidæ*, *Lithosiidæ*, *Pericopidæ*, *Arctiidæ*, *Euchromiidæ*, *Lymantridæ*, and perhaps also the *Thyridiidæ*,

\* "Relationship of *Pyralidæ* and *Pterophorina* from the Larvæ," Ent. News, Feb., 1895.

† "Not in the sense used by Professor Smith. My classification corresponds more nearly with that of Grote's Check List, 1882."

*Dioptidæ*, and *Lasiocampidæ*.\* The SPHINGINA—the *Sphingidæ*. The RHOPALOCERA—the families usually associated under this term.”

It will be seen by reference to Mr. Dyar's previous summary that this more recent pronouncement does not explain away any of the difficulties which I have previously criticised; but, on the contrary, by its more definite character tends rather to accentuate them.

In order to make this paper as complete as possible, and to ensure that I had not mis-stated the intentions of the authors, I submitted it to Dr. Chapman and to Mr. Hampson. Dr. Chapman offers only one remark, viz., that “The answer (or excuse) for lumping the group called MACROS, is identical with that which will probably be given by the other writers quoted for lumping the TINEINA and RHOPALOCERA, viz., that so far as we have yet carried our studies, our methods do not enable us to do so with certainty” (in litt., Feb. 14, 1895).

Mr. Hampson writes at considerable length. He says:—“I am extremely obliged to you for allowing me to see your paper on the ‘Classification of the Lepidoptera,’ the more so, as I am afraid a sharp bout of influenza will prevent my being at the Entomological Meeting next Wednesday. I wrote the review of Professor Comstock's system, and added to it a summary of the progress made in the work of re-distributing the families of Lepidoptera into a natural system of classification, with the express object of showing what had been done, and of clearing the ground for, and helping to call forth, the next step in advance, a result, I am happy to see by your paper, has been attained.

“I note that in my review I omitted to state that I left the *Tineidæ* alone, because I have not specially studied them; not because I think they represent a single family equivalent to the others, and I am only waiting for those who have been studying them as imagines—such as Lord Walsingham and Mr. Meyrick—to give us their results. There is no published classification of the families, that I know of, based on imaginal characters, and the commonly received characters separating the *Tineidæ* and *Tortricidæ* are entirely fallacious and have to be rejected; but there are plenty of characters for a

\* “These I have not examined sufficiently. The *Lasiocampidæ* will probably form another superfamily.”

new and more natural reconstruction into families, which I hope will be done before long. As far as I am able to judge, however, the *Tineidæ* represent the ramifications of one branch of the Lepidoptera, some families generalised, others highly specialised, and not a heterogeneous collection of families sprung from various parts of the Lepidopterous tree as the old family BOMBYCES did.

“The same remark applies to the RHOPALOCERA. I left them alone because I had not studied them; but here I am doubtful if we have not four different stocks: the *Hesperidæ* arising from the *Castniidæ*; the *Erycinidæ* and the *Lycænidæ* from near the *Callidulidæ*; the *Papilionidæ*, as also the *Pieridæ* and *Nymphalidæ* from the Zygæno-Cossid stock; but these suggestions are not based on any very careful examination.

“The *Lasiocampidæ*, *Endromidæ*, and *Arbelidæ* are out of place in my artificial key, because in such a key it is always practically impossible to get quite a natural order, and I have not yet found a character common to them, and not found in other families, which would place them together in their natural position at the bottom of the OBTECTÆ. The *Lasiocampidæ* and *Endromidæ* I believe to have developed from the *Limacodidæ*, the *Arbelidæ* from the *Cossidæ*.

“There is a point in your paper that I entirely disagree with, the larva is *not* an embryo, being subject to the struggle for existence and to modification in relation to environment, and arguments based on superficial larval characters, such as Mr. Dyar’s setiferous tubercles, are in no sense on a par with arguments from embryology; and if the results he had obtained had been entirely negative, it would have shown that the character he examined was faulty and would not have invalidated the results obtained from the neuration of the imago which is not changed by external circumstances, except to some degree when the shape of the wing is much modified.

“Dr. Chapman’s pupal characters are not so liable to this objection, especially the mode of dehiscence, the pupa itself being more of the nature of an embryo, and the methods of emerging from the pupa are less liable to the action of natural selection; but I believe these characters of his INCOMPLETEÆ, as well as the emergence of the pupæ from the cocoon, primarily to have relation

to a boring life during the larval stage, in reeds, wood, or roots, and I should much like to see an examination of the many scattered species in the higher families that have returned to boring during the larval stage, such as *Virachola perse* and *isocrates* in the *Lycænidæ*.

“That we shall soon have a good natural classification of the Lepidoptera, which will be confirmed by characters based on all the stages, is hardly open to doubt, seeing how many good workers there are in the field and the progress already made, and I will do my best to forward it, both on my own account and to help others; and to this end am asking for pupæ from my various correspondents in India, and have just received one parcel from Mysore and hear of another on its way from Bhután, each with the pupæ of a certain number of species. Should you care to read this letter at the Entomological Meeting with your paper, you are quite at liberty to do so.”

This letter leaves but little to say. It confirms my supposition as to Mr. Hampson's treatment of the *Tineidæ* and *Rhopalocera*, which is the most important point so far as this paper is concerned. With regard to the remarks on the larva I quite agree with Mr. Hampson that they are subject to “the struggle for existence,” but so, indeed, are even the molecules of animal tissues if the recently developed theory of intra-selection be correct, and it is certain that they are also subject to “modification in relation to environment,” but I disagree with him that setiferous tubercles are “superficial larval characters” in the sense assumed. Every larva inside or outside of the eggshell possesses them, and even in its most restricted sense the structures are embryological, and it is in the very fact that they are subject to modification that we find them of service for the purpose of classification, and that we are enabled to separate specialised from generalised forms. The varied stages of development of the setiferous tubercles sometimes reached in allied genera in the egg is of the highest significance, as is also their comparative development in the various stages of larvæ in allied genera, as in *Ornithoptera* and *Papilio*, in *Agria* and *Citheronia*; whilst Packard states that the tubercles of the species of *Saturnia* (*carpini*, *pyri*) are on the same plane with the embryo, just before exclusion, of the more highly

specialised forms of the group *Attacinæ*;" and again, "whilst the late embryos of the *Attacinæ* are perhaps paralleled by the fully-grown larva of *Saturnia*, the fully-grown larva of the most, or one of the most, generalised *Attacinæ*, *Platysamia*, is on the same plane of specialisation as the larva of *Callosamia* in its third stage."\* It seems to me that Mr. Hampson and I mean alike, the difference is purely a matter of words, whether we choose to call the larva an embryo or not. My statements in the early part of the paper appear to be in no way antagonistic to those in Mr. Hampson's letter. To explain why I prefer to consider the larva to be embryonic in many respects, would occupy too much space here and not advance the subject under discussion.

Quite recently Mr. Vernon L. Kellogg has shown † that *Micropteryx* and *Hepialus* have, in addition to the ordinary scales on the wings, a covering of very fine hairs differing radically from the scales in size, arrangement and mode of attachment to the membrane—a Trichopterygid character. These hairs have not yet been discovered in any FRENATÆ. The paper deals also with, and illustrates, types of thoracic structure confirming Comstock's classification.

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\* Packard, "Studies on the Transformation of Moths of the Family Saturniidæ," Proc. of the Amer. Acad. of Arts and Sciences, 1893.

† "The Classification of the Lepidoptera," American Naturalist, Vol. xxix., pp. 248-57; Plate xvii.